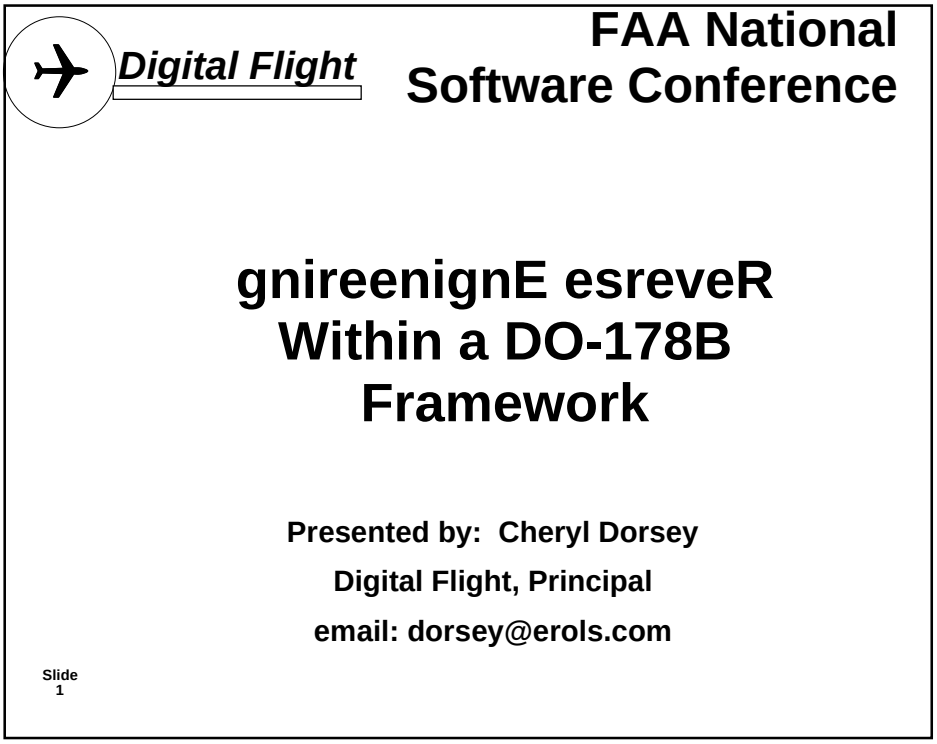
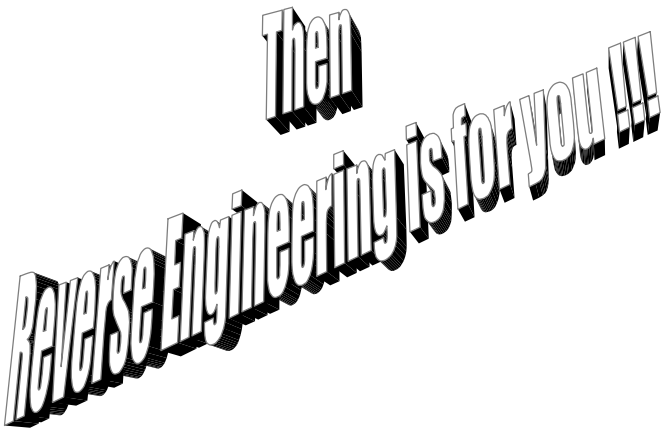

Digital Flight
FAA National Software Conference
gnireenignE esreveR Within a DO-178B Framework
Presented by: Cheryl Dorsey
Digital Flight, Principal
email: dorsey@erols.com
Slide 1

Digital Flight
• Is your product team retiring to Florida?
• Has marketing said you have a 100k SLOC Level A Certifiable System and you don't know what level A is?
• Customers finding all your undocumented features?
• Is your technical product guru blackmailing you?
Slide 2

Digital Flight



Slide 3

Digital Flight

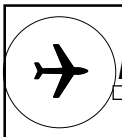
Presentation Objectives

Understand:

- **what is reverse engineering, why it is used, and the relative pros and cons to using this approach**
- **what's next after going backwards**
- **how to use DO-178B Annex Tables A-1 through A-10 with respect to reverse engineering process**

Slide 4

Reverse Engineering



Digital Flight

What is It ?

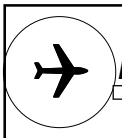
Reverse Engineering:

"engineering process of understanding, analyzing, and abstracting the system to a new form at a higher abstraction level." (Source: Chikofsky and Cross)

Design Recovery:

"a subject of reverse engineering in which domain knowledge, external information, and deduction or fuzzy reasoning are added to the observations of the subject system to identify meaningful higher level abstractions beyond those obtained directly by examining the system itself." (Source: Chikofsky and Cross)

Slide 5



Digital Flight

Why Reverse Engineer ?

- **Product already exists, none or little documentation (COTS)**
- **Product exists but after years of maintenance, it has become too fragile to upgrade or fix**
- **Prototype code exists (works, but not sure why)**
- **Developed to one standard and need to upgrade baseline to another standard (e.g. DO-178B)**

Slide 6

Digital Flight

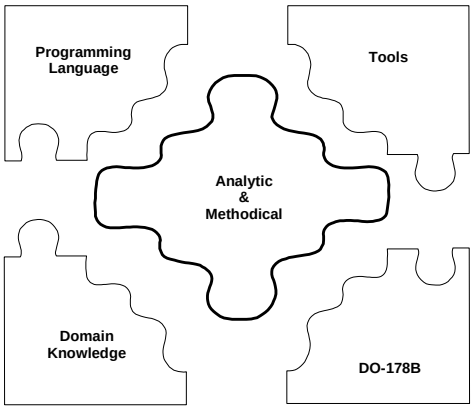
Successful Reverse Engineering Projects

- GE Spare Bill System
- F-14A AWG-9
- TCAS (IV&V-- Really reverse engineered)
- SPY-1A Weapons Control System
- Power Distribution System
- FAA approved ground system
- FMS
- COTS Operating System(s)

Slide 7

Digital Flight

Skills Required



Slide 8

Digital Flight

What Makes It Work?

- rigorous well defined process in place
  - plans
  - templates
  - tools
- multidiscipline team all with strong cognitive ability
- communication
- access to the experts (if they still exist)
- experience
- good working knowledge of DO-17B

Slide 9

Digital Flight

It's All In The Details

- code is overly complex
- poorly and incorrectly documented
- unused sections/pieces
- abstract up is much harder than decomposing
- automated approach has limited usefulness

Slide 10

Digital Flight

Common Things Found !

- Variables not initialized
- Problems with pointers
- Data not being defined consistently
- Data not being used consistently (type, units)
- Incorrect algorithms
- Parts of software that do not work together
- Startup (warm, cold) not thought through
- Scenarios not thought through
- Incorrect order of events (especially after error handling)
- Built in test is not built in
- Data being produced or passed but never used

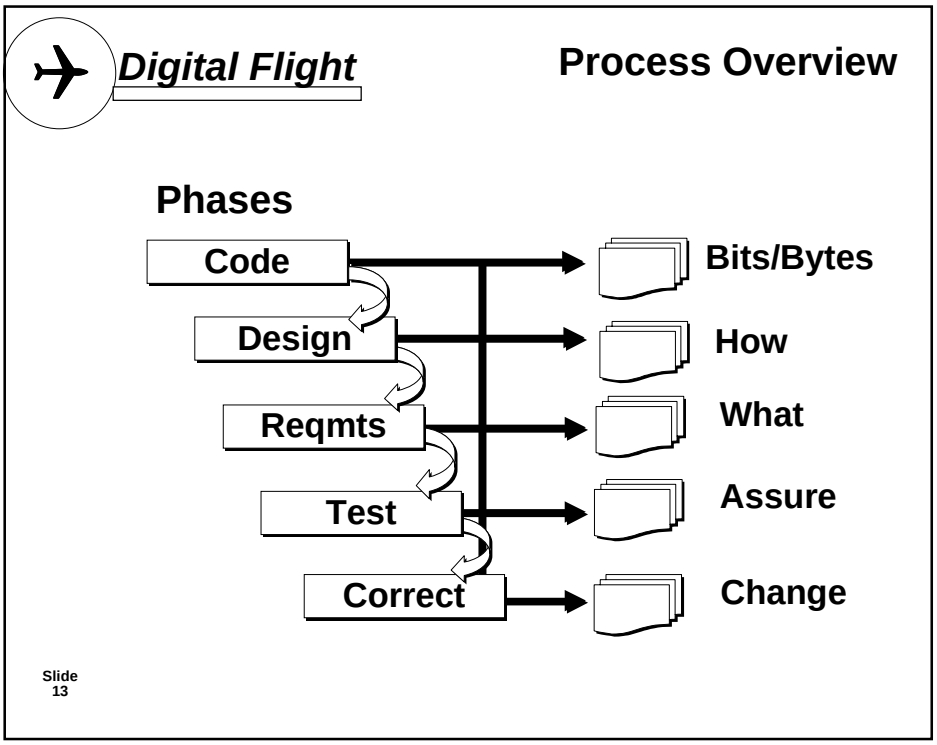
Slide 11

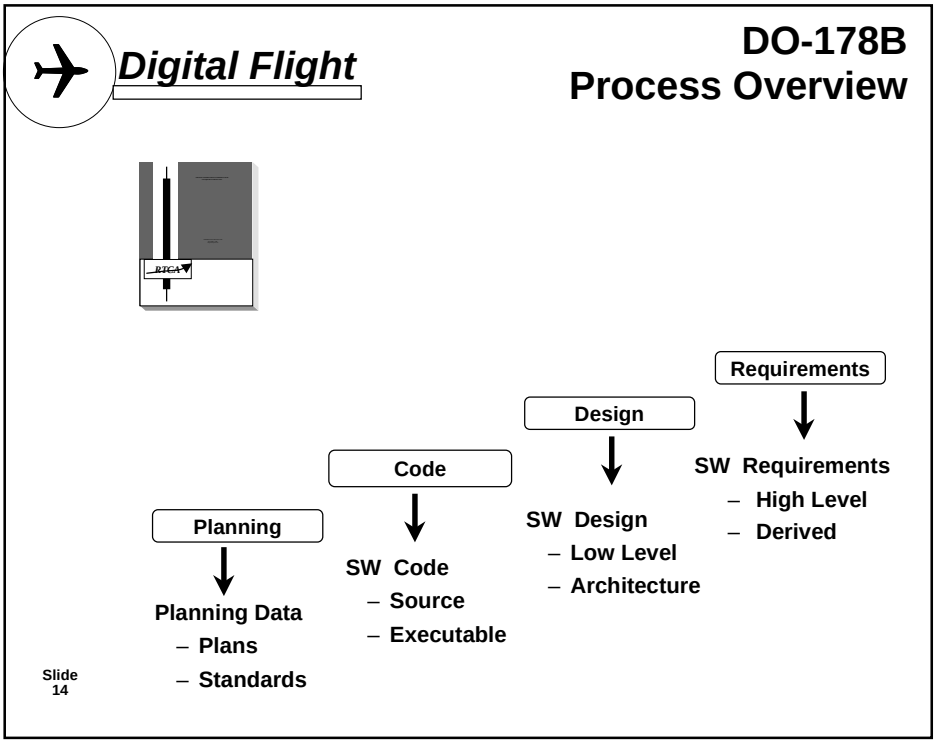
Digital Flight

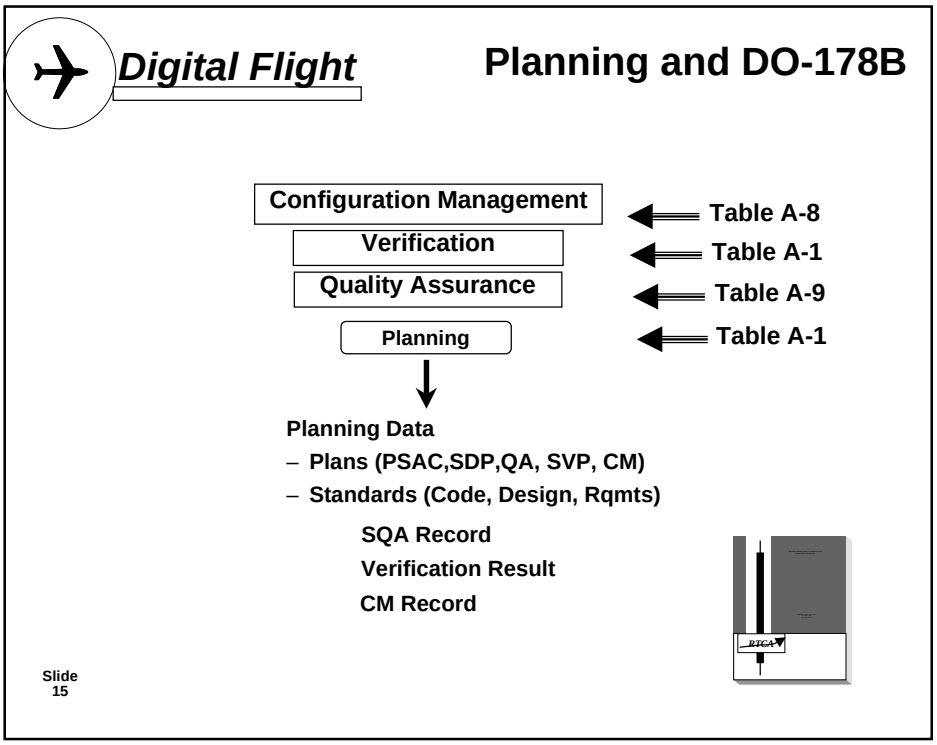
Advantages of Reverse Engineering

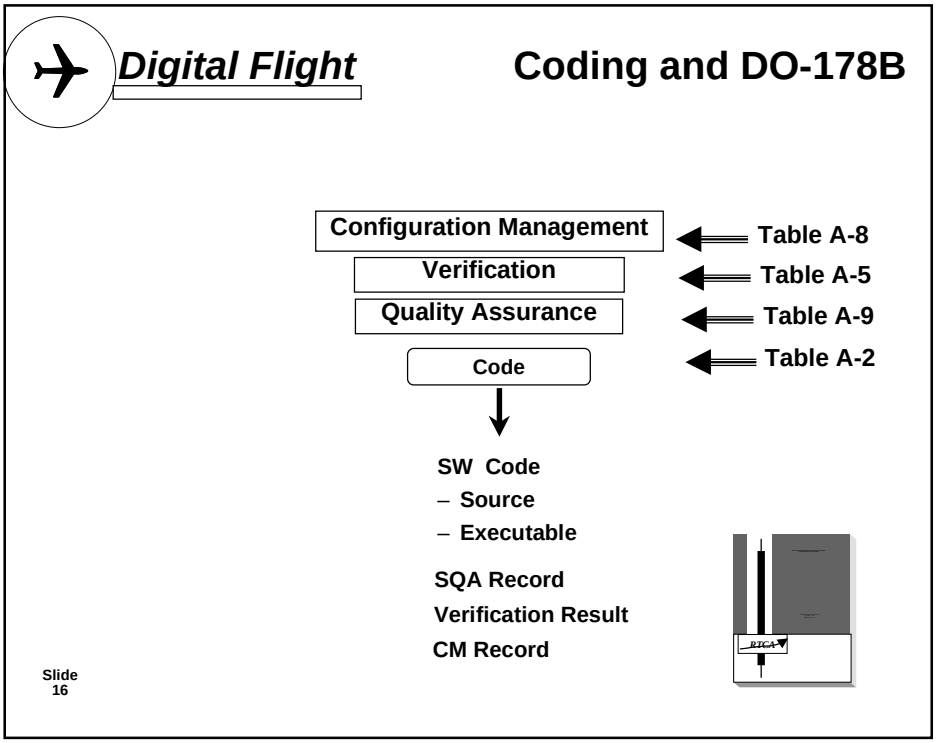
- Can be cost and schedule effective
- Low cost compared to developing and incorporating changes
- Re-institutionalize technical knowledge about a product
- Finds more esoteric errors
- Springboard for next-generation product

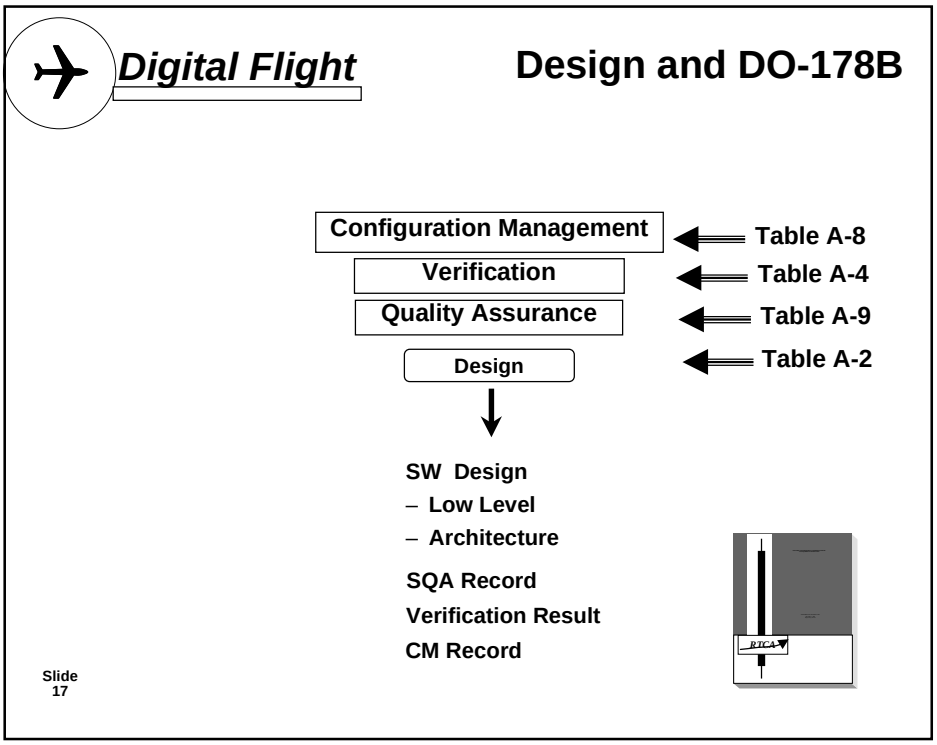
Slide 12

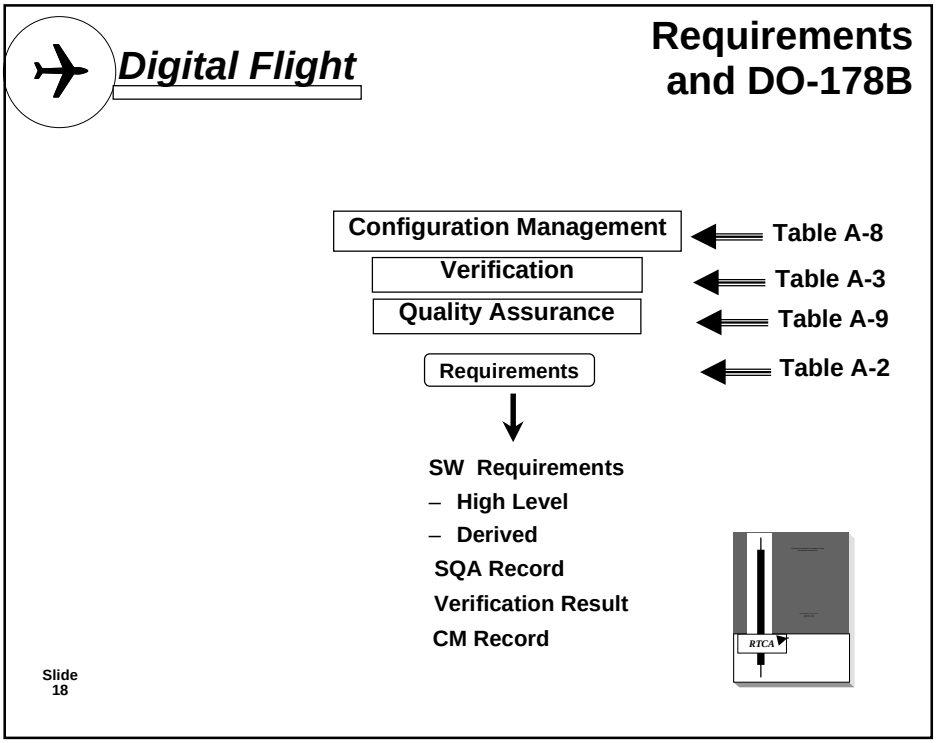

Digital Flight
Process Overview
Phases
Code
Design
Reqmts
Test
Correct
Bits/Bytes
How
What
Assure
Change
Slide
13


Digital Flight
DO-178B
Process Overview
RTCA
Planning
Planning Data
– Plans
– Standards
Code
SW Code
– Source
– Executable
Design
SW Design
– Low Level
– Architecture
Requirements
SW Requirements
– High Level
– Derived
Slide
14


Digital Flight
Planning and DO-178B
Configuration Management
Verification
Quality Assurance
Planning
Table A-8
Table A-1
Table A-9
Table A-1
Planning Data
– Plans (PSAC,SDP,QA, SVP, CM)
– Standards (Code, Design, Rqmts)
SQA Record
Verification Result
CM Record
Slide 15


Digital Flight
Coding and DO-178B
Configuration Management
Verification
Quality Assurance
Code
Table A-8
Table A-5
Table A-9
Table A-2
SW Code
– Source
– Executable
SQA Record
Verification Result
CM Record
Slide 16


Digital Flight
Design and DO-178B
Configuration Management
Verification
Quality Assurance
Design
Table A-8
Table A-4
Table A-9
Table A-2
SW Design
– Low Level
– Architecture
SQA Record
Verification Result
CM Record
Slide 17


Digital Flight
Requirements and DO-178B
Configuration Management
Verification
Quality Assurance
Requirements
Table A-8
Table A-3
Table A-9
Table A-2
SW Requirements
– High Level
– Derived
SQA Record
Verification Result
CM Record
Slide 18

Digital Flight

So where's the testing (Table A-6)?

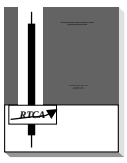
Slide 19

Digital Flight

Testing and DO-178B

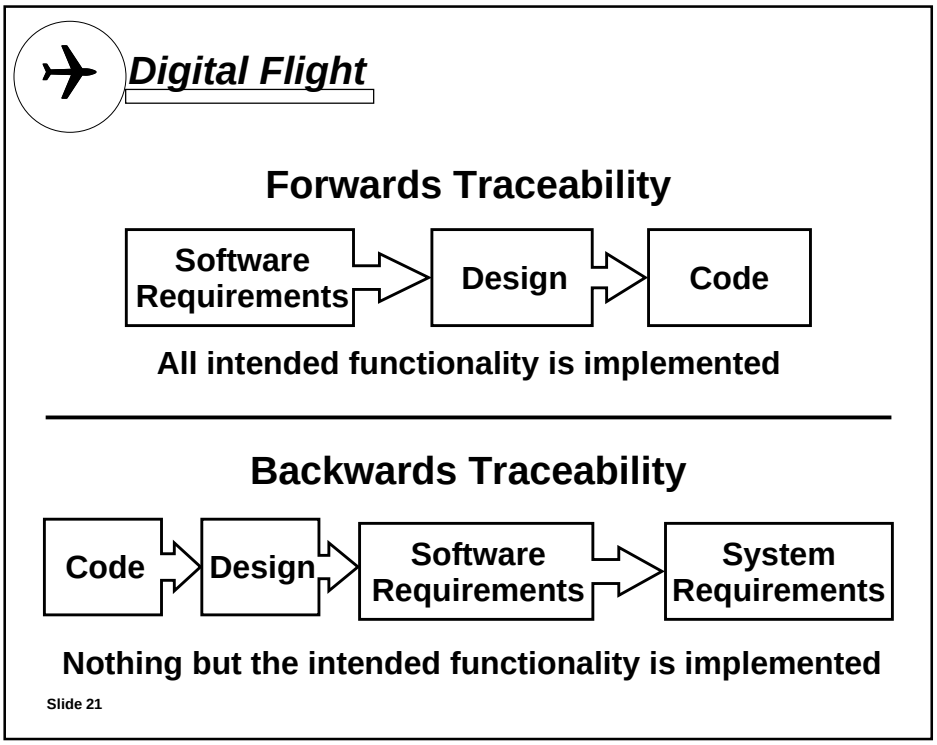
Configuration Management	Table A-8
Quality Assurance	Table A-3
Verification	Table A-7
Test Outputs of Integration	Table A-6

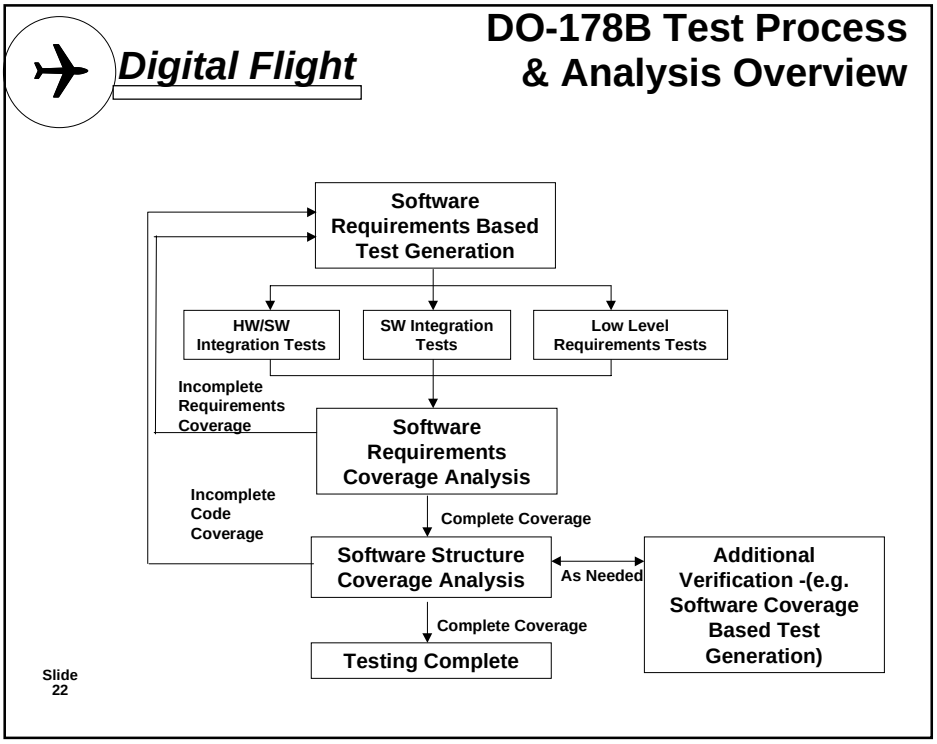
- Test Cases & Procedures
- Test Results
- Verification Result
- SQA Record
- CM Record



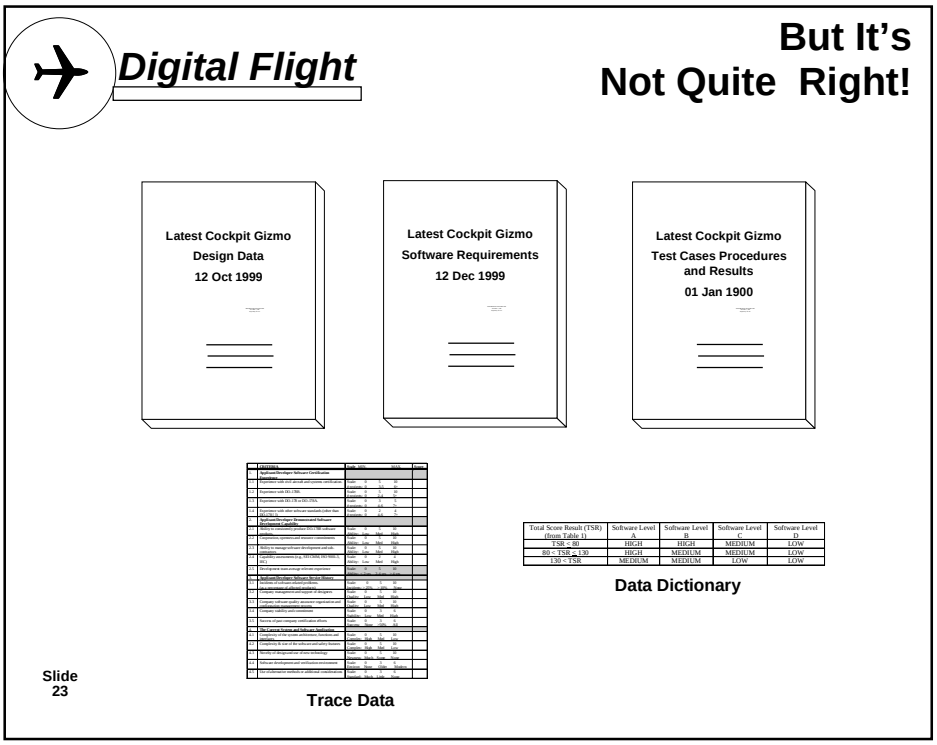
Slide 20

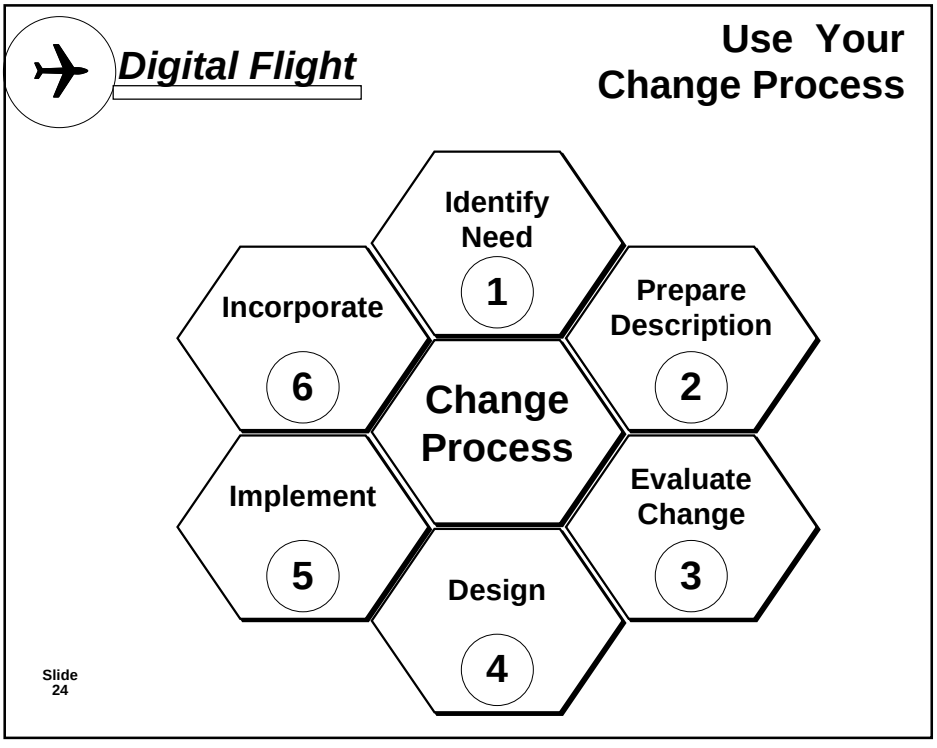
Reverse Engineering





Reverse Engineering





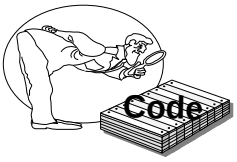
Digital Flight

Summary

- Reverse Engineering life cycle model can be formally implemented.

- **Not easy but with the right process and people it is doable.**

- **There are advantages from a safety perspective (it finds stuff)**



Slide 25